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memorandum

Los Alamos Neutron Science Center (LANSCE-DO)

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SUBJECT: LANSCE USER FACILITY OPERATIONS

Introduction

The LANSCE User Facility Operations schedule for the calendar year 2001 run cycle is available on the web at:

http://mesa53.lanl.gov/operations/Schedules/schedules.html

The LANSCE user facility will operate for 6 months from 01 July through December 2001.The decision to operate for 6 months in 2001 reflects priorities established by LANSCE management following the advice of sponsors from DOE Defense Programs (DP), DOE Office of Basic Energy Sciences (BES), and the DOE Office of Nuclear Energy, Science, and Technology (NE). At an Oct. 2000 meeting held in Washington, the sponsoring agencies agreed that the highest priority for LANSCE in calendar 2001 was to run safely, reliably and predictably for as long as possible with the following constraints;

1) that required accelerator maintenance be carried out (necessary for safe, reliable operation),
2) that a cooling tower replacement project be brought to completion (necessary for long term operation),
3) that progress on the construction work for the Isotope Production Facility be maintained on schedule, and
4) that an acceptable “Authorization Basis” for the operation of the non-nuclear part of the LANSCE Accelerator be established to allow for operation within DOE regulations.

In December, LANSCE management presented a detailed 2001 outage to the same set of sponsors. This outage plan included the above tasks and sufficient contingency to allow a high level of confidence that the user program would commence on 01 July 2001. In December, that plan was accepted by the sponsors with the explicit understanding that no other activities would be carried out during the outage unless it was clearly demonstrated that these would not compromise the 01 July start of the user program. Details of the outage are available on the web at:

http://mesa53.lanl.gov/operations/outage.html

In parallel with those activities, the LANSCE Program Planning Group (LPPG) met on several occasions to formulate the 2001 beam delivery schedule. The schedule was refined

following discussions with affected program managers as well as line managers within and outside of LANSCE. The schedule was also presented for comment to the LANSCE User Group Executive committee at their February 2001 on-site meeting. The 2001 user facility production schedule represents the best effort to run safely and reliably, to satisfy the DP and BES scientific objectives at the Lujan Center, WNR, and to support other DP programmatic needs for the LANSCE accelerator (e.g. Proton Radiography) within the existing budget.

The actual start-up of the accelerator begins several weeks in advance of the start of the user program. The accelerator will be operational in June for tuning and other activities. While some experimental activities may be possible during this period, user activities will be not be scheduled. The schedule for all LANSCE accelerator activities before 01 July is described in the LANSCE Outage Plan, accessible at:

http://mesa53.lanl.gov/operations/outage.html

Key to understanding the production schedule is recognition that the LANSCE accelerator facility is quite complex, with the capability to deliver beam to many different targets and experimental areas. LANSCE is currently authorized to deliver beam to Target 1 (the Lujan Center), to Target 2 (WNR "Blue Room"), to Target 4 (WNR), to Area C (Proton Radiography), or to Line B (Ultra Cold Neutron Development). Beam delivery to the Lujan Center and/or WNR target 4 can be carried out simultaneously. However beam delivery to other areas normally requires that delivery to the Lujan Center and WNR target 4 be suspended. Typical "change-over" time is on the order of a few hours.

The schedule describes the relative allocation of time between beam delivery to the Lujan Center/ WNR and "Sole Use" activities. "Sole Use" activities include but are not limited to Defense Programs proton radiography activities in Line C, Proton Storage Ring (PSR) delivery to the Blue Room, use of the accelerator for development purposes, and PSR tests.

The schedule explicitly includes contingency to insure that critical programmatic objectives and scientific activities are not compromised due to operational problems. The amount of schedule contingency and the method for its allocation are discussed below.

Discussion

The accelerator operations schedule follows an ~28-day rhythm that is dictated by the lifetime of the H^- ion source. Three days out of each 28 are allocated to the ion source recycle[1]. During this period, the accelerator is not operational and no beam can be delivered.

[1] The source recycle in Aug is compressed to 2 days to accommodate one day of re-tuning when the linac duty cycle is increased from 40Hz to 120 Hz.

The accelerator operations groups take advantage of this time to perform a variety of preventative and corrective maintenance activities.

The Lujan Center Target Moderator ("1L") systems require periodic preventative maintenance. Five days out of each 28-day period are allocated to this work. The first three days of the "1L maintenance" are scheduled concurrently with the three-day source recycle. During the last two days of the 1L maintenance period, H^- beam delivery is possible for many, but not all, Sole Use experiments.

The remaining 23 days of the 28 are distributed into three blocks of beam time. The first block of time (typically) 9 days is allocated to Lujan Center/WNR. This is followed by (typically) 4 days of Sole Use Beam Delivery. A period of Monday through Thursday is allocated for these activities to ensure the availability of special operational support personnel (from outside of LANSCE) who are required for the handling of high explosives. The 4-day period is typically followed by a day of "monthly" reserve/contingency.[2] This day is held as make-up time for earlier scheduled activities that did not receive their full beam time allocation or for high priority opportunities identified after the establishment of the detailed experimental schedule. The policy for the allocation of this monthly contingency is described in the Appendix to this memo. The contingency time is followed by a (typically) 9-day allocation to Lujan/WNR.

The establishment of a regular rhythm to the production schedule represents a departure from the 2000 run cycle. There was a broad consensus that such a rhythm would be highly desirable.

The schedule identifies 107 days for Lujan/WNR, 36 days for Sole Use, and 13 days for contingency/reserve. The Lujan Center is scheduled to receive ~82% of the scheduled time for which Target 1 operation is possible. Sole use activities are schedule to receive 25% of the available scheduled time.[3] It should be noted that the LANSCE operations and research budgets are not sufficient to accommodate a significantly larger Sole Use Program.

Beam Tuning

A substantial portion of the LANSCE operations budget is for electric power. Electricity for one month of full power operation (at 120 Hz) is approximately $1M. Of that, approximately 40% is a fixed cost with the remainder dependent on accelerator duty factor.

[2] July is the first month of the user program and a reserve contingency day was not included.
[3] Certain types of sole use activity can be scheduled while 1L maintenance is in progress.

Normal Lujan/WNR operation consists of linac operation at 120 Hz with 20 Hz directed to the Lujan Center and 100 Hz to WNR. Sole use operation, on the other hand, normally requires a much lower duty cycle. As a cost saving measure the accelerator duty factor is reduced during Sole Use operation. This anticipated routine transition involves a partial re-tuning of the 805 MHz Side Coupled Linac, a process requiring a few hours. Beam is not available to experimental areas during this process. The notional periods for re-tuning activity are noted in the production schedule.

Change Over Between Activities

Because the transition between Lujan/WNR and Sole Use requires re-tuning, the schedule must include time to accommodate this change over. The exact start, stop, and changeover times are depicted only notionally in the production schedule. The default stop and start times for transitions between activities are:

From Sole Use to Lujan/WNR:

Sole Use ends at midnight; Lujan/WNR starts 0700;
From Lujan/WNR to Sole Use:
Lujan/WNR ends at midnight; Sole Use starts 0700;
From Lujan/WNR to Source Recycle:
Lujan/WNR ends 0700; Source Recycle starts 0700;
From Source Recycle to Sole Use:
Sole Use starts at 0700;
From Monthly Contingency/Reserve to Lujan/WNR:
Lujan/WNR starts 0700.
From Sole Use to Monthly Contingency/Reserve:
Sole Use ends at midnight.

The transition times are presented for planning purposes only. Users should be aware that they are subject to some modification (typically not more than a few hours). ***Actual changeover times are contained in the detailed operations schedule that gives an hour by hour schedule for accelerator activities.*** This schedule is prepared and maintained approximately two weeks in advance of operations. The detailed operations schedule is available on the web at:

http://mesa53.lanl.gov/operations/Schedules/stSchedule.html

Duty Cycle

FY 2001 funding levels for LANSCE are not sufficient to support normal operation for Lujan/WNR during FY01. As a result, our production schedule calls for a reduction of duty factor to WNR from the normal 100 Hz to 20 Hz during July and part of August (The linac

will run at 40 Hz during this period). The effect of this budget shortfall is an 80% reduction in WNR capability for ~5 weeks.

Contingency/Reserve

There are two classes of reserve/contingency noted on the production schedule; “monthly” and “end of run cycle” Typically there is a “monthly” contingency day that follows each four-day Sole Use period. While this monthly contingency is not explicitly held for Sole Use activities, it anticipated that it will be used primarily to accommodate experiments that, due to operational or other problems, did not receive their full allocation of time during an earlier month. End of cycle time is held for all activities and is specifically intended for (though not limited to) for Lujan/WNR activities that lost significant portions of beam time. The policy for allocation of contingency time is outlined in LANSCE “Operations Schedule Change Procedure” (See appendix).

The amount of schedule contingency was based upon the 2000 operational experience. In particular, the amount of end of cycle contingency time is comparable to the amount of lost time in 2000 that occurred in large blocks (i.e. ≥1day).

Production Schedule Glossary:

1L Maintenance, Preventive and Corrective maintenance to the Lujan Target Moderator system. This is typically a 5-day activity during which beam delivery to the Lujan Center is not possible. Other beam delivery activities may be affected due to access control limitations.

Lujan/WNR, Beam Time allocated to Lujan Center Operation and WNR. Typically this involves beam delivery to target 4.

Reserve/Contingency, Beam time held as make-up time for earlier scheduled activities that did not receive their full allocation or for high priority opportunities identified after the establishment of the detailed experimental schedule. There are two classes of reserve/contingency on the production schedule; “monthly” and “end of run cycle” Typically there is a “monthly” contingency day that follows each four-day Sole Use period. While this monthly contingency is not explicitly held for Sole Use activities, it anticipated that it would be used to accommodate experiments that, due to facility problems did not receive their full allocation of time during an earlier month. End of cycle time is held for all activities. The policy for allocation of contingency time is outlined in the LANSCE “Operations Schedule Change Procedure”.

Re-tune, typically, a readjustment of the linac and other accelerator systems to accommodate a change in operational duty cycle. Re-tuning the Side-Coupled Linac (the “805”) is relatively straight forward requiring a few hours. This is typically done when changing between Sole Use and Lujan/WNR (and vice versa).

Sole Use, Beam delivery that precludes operation of the Lujan Center and/or WNR Target 4. This includes, but is not limited to, Proton Radiography, PSR beam delivery to the “Blue Room” (e.g. Neutron Resonance Radiography), PSR development work, and beam delivery to Line B.

Source Recycle, typically a three-day activity during which the H^- ion source is replaced by a refurbished source. The ion source is replaced after approximately 25 days of accelerator operation. During Source recycles, a broad range of preventive and corrective maintenance is performed on the accelerator and the conventional facility.

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